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202301UECM2453OE1a

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Started on	Monday, 6 February 2023, 01:06 PM
Completed on	Monday, 6 February 2023, 01:06 PM
Time taken	16 secs
Grade	0 out of a maximum of 10 (0%)

1



Marks: 1

Suppose that Y follows the stochastic differential equation

$$dY(t) = -2dt + 2dZ(t)$$

where Z(t) is a standard Brownian motion.
Let $X(t) = e^{5tY(t)}$. If

$$dX(t) = a[X(t),t]dt + b[X(t),t]dZ(t),$$

find $a(3,1)$. _____


Answer:

[Make comment or override grade](#)

Incorrect
Correct answer: 123.295837

Marks for this submission: 0/1.

2



Marks: 1

Assume that S(t) follows an arithmetic Brownian motion: $dS(t) = \alpha dt + \sigma dZ(t)$. If $d(35S^5(t) + 2t) = a[S(t),t]dt + b[S(t),t]dZ(t)$, find $a(10,3)$ for $\alpha = 0.018000000000000002$ and $\sigma = 0.23$. _____


Answer:

[Make comment or override grade](#)

Incorrect
Correct answer: 50017

Marks for this submission: 0/1.

3



Marks: 1

Let Z(t) be a standard Brownian motion. You are given:

- $R(t) = R(0) e^{-1.0t} + 0.072(1 - e^{-1.0t}) + 0.33 \int_0^t e^{-1.0(t-s)} \sqrt{R(s)} dZ(s),$
- $Y(t) = [R(t)]^3.$

Suppose that $dY(t) = a[t, Y(t)]dt + b[t, Y(t)]dZ(t)$. Find $dY(t)$ and hence calculate $a(2, 0.15)/b(2, 0.15)$. _____

Answer:

[Make comment or override grade](#)

Incorrect
Correct answer: -1.456816

Marks for this submission: 0/1.



Marks: 1

Stock prices follow geometric Brownian motion:

$$d\ln S(t) = 0.026dt + 0.12dZ(t).$$

Suppose $S(0) = 49$. Calculate $P[S(3) < 46]$. _____

Answer:

✗

[Make comment or override grade](#)

Incorrect

Correct answer: 0.2483

Marks for this submission: 0/1.



Marks: 1

You are given:

- $S(t) = S(0)e^{0.11t+0.32Z(t)}$
- $\delta = 0.04$
- $F_{t,T}$ is a forward on the stock.
- $r = 0.07$

 $d(\ln F)$ follows the process $\alpha dt + \sigma dZ(t)$. Determine α . _____

Answer:

✗

[Make comment or override grade](#)

Incorrect

Correct answer: 0.08

Marks for this submission: 0/1.



Marks: 1

Let $Z(t)$ be a standard Brownian motion. You are given that

$$Y(t) = 4 + 4e^{-0.52t} + 0.33 \int_0^t e^{-0.52(t-s)} dZ(s).$$

Let $X(t) = Y^3(t)$. Suppose

$$dX(t) = a(t, X(t))dt + b(t, X(t))dZ(t).$$

Find $a(1,1)$. _____

Answer:

✗

[Make comment or override grade](#)

Incorrect

Correct answer: 5.0067

Marks for this submission: 0/1.



Marks: 1

Interest rates $r(t)$ satisfy the SDE

$$dr(t) = 0.22(0.29 - r(t))dt + 0.29[r(t)]^{0.5}dZ(t)$$

A solution for $r(t)$ is

$$r(t) = A + (r(0) + B)e^{Ct} + De^{Et} \int_0^t e^{Ft} [r(s)]^{0.5} dZ(s)$$

where A, B, C, D, E and F are constants. Determine $B + C + D + E + F$. _____

Answer:

✗

[Make comment or override grade](#)

Incorrect

Correct answer: -0.22

Marks for this submission: 0/1.



Marks: 1

Let $S(t)$ be the time- t price of a nondividend-paying stock, you are given that the stock price process is

$$d[\ln S(t)] = -0.02005dt + 0.39dZ(t), \quad S(0) = 3$$

where $Z(t)$ is a standard Brownian motion under the true probability measure. Calculate $\text{Cov}(S^2(3), S^4(5))$. _____

Answer:

✗

[Make comment or override grade](#)

Incorrect
Correct answer: 17734980.32

Marks for this submission: 0/1.

9

Marks: 1

The price of a stock follows the stochastic differential equation:

$$dS(t)/S(t) = 0.028dt + 0.27dZ(t)$$

where $Z(t)$ is a standard Brownian motion. Consider the geometric average

$$G = [S(1)S(3)S(5)]^{1/3};$$

Find the variance of $\ln G$. ____

Answer:

[Make comment or override grade](#)

Incorrect

Correct answer: 0.1539

Marks for this submission: 0/1.

10

Marks: 1

You are given:

- $S(t)$ is the time- t price of a nondividend-paying stock.
- $S(t)$ follows a geometric Brownian motion.
- The current stock price is 44.
- The expected return on the stock is 0.12.
- The stock's volatility is 0.22.

Calculate $E[S(2)|S(2) > 44]$. ____

Answer:

[Make comment or override grade](#)

Incorrect

Correct answer: 62.915419

Marks for this submission: 0/1.